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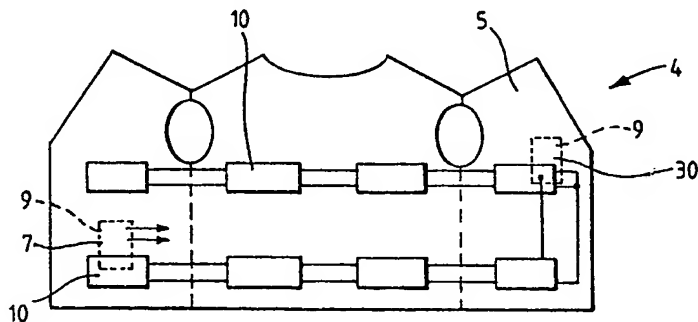
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54 Thermal garment.

57 A close fitting thermal garment (4) for combating hypothermia having both a plurality of resistive heating means (10) and a pocket for supporting a battery pack (7). The battery pack is connected in series with the resistive heating means. The garment may also be provided with a control unit (30) that not only enables the wearer to adjust the temperature level of the garment but also provides an indication that the garment is in use and when the battery power is low.

Fig.1.



THERMAL GARMENT

The present invention relates to a battery powered thermal garment.

There has been much concern recently about the effects of hypothermia during cold weather, especially in relation to the elderly who are particularly prone to succumb to the effects of hypothermia. The rising cost of heating even a single room has meant that in extremely severe weather, elderly people of limited financial resources have felt unable to heat their homes sufficiently to prevent them suffering from hypothermia.

There have been proposals for providing means for heating the individual person, such as electric blankets. These have the disadvantages that they prevent the person moving far away from an electrical socket, if at all, and that they can be dangerous since they are connected to the mains electricity supply.

There is therefore a need for a device for heating an individual person which does not prevent the person from moving, which is safe to operate and which has low running costs. The present invention is intended to provide such a device. It is also intended to provide a device that can operate at a temperature level which can be selected by the wearer by means of a simple detachable control unit.

According to the present invention there is provided a close fitting thermal garment provided with: a plurality of resistive heating pads; a reinforced pocket for receiving a rechargeable battery pack; and means for connecting the battery pack in series with the resistive heating pads, wherein the total resistance of the resistive heating pads is between 4 and 8 ohms and the circuit is adapted to operate at a voltage of from 4 to 10 volts.

Preferably, each resistive heating pad comprises a pair of parallel conducting strips which are electrically interconnected by a number of resistors arranged electrically in parallel to give the desired power output over the area of the pad. Terminals, electrically connected to the respective ends of the conducting strips, are also provided. All the electrical components are encapsulated and are provided in the form of a flexible plastic card.

Preferably, the thermal garment includes a control unit detachably connected between the battery pack and the heating pads. The control unit advantageously includes any of the following items: an on/off switch; means for adjusting the desired temperature level; means for indicating that the circuitry is switched on; means for indicating that power is being supplied to the heating pads; means for indicating that the output from the bat-

tery pack is below an acceptable level caused by operation of the circuitry.

Preferably the low output indicating means includes both an audible and a visible indicating means. This is a desirable feature since, for instance, nickel/cadmium batteries tend to operate efficiently only down to a voltage of about 5 volts. If the battery is allowed to discharge below this level, it may become damaged. The low output indicating means on the detachable control unit therefore provides an indication to the user that the battery pack needs recharging.

Preferably, the temperature level adjusting means is arranged so that a maximum temperature of about 32°C is obtainable by the garment. A suitable means is a thermistor or similar temperature probe.

Preferably, the heating pads and control unit are removably located in or on the thermal garment so that they may be readily removed to allow the garment to be washed.

The garment may include buttons, belts and/or zips to enable it to be readily put on or taken off. Preferably the sides of the garment at least are elasticated to ensure that the resistive heating pads are brought into contact with the wearer.

Advantageously, the garment is made of a material that is highly insulating, which will enable the wearer to retain the heat which is generated. Such material is well known and is incorporated into garments generally sold as "thermal underwear". Preferably, the material is also fire retardant.

Preferably, the garment comprises two layers, the outer layer having on its internal face a number of sealable pockets for removably receiving the heating pads. Advantageously, the pockets are sealable by use of Velcro®. The outer layer on its outer face will include the pocket for the battery pack and a pocket for the control unit, if used. The inner layer may comprise a liner.

Advantageously, the garment is provided with a number of heating pads, preferably four, which in use provide heat to the lower chest and lower back areas. It will of course be appreciated that the heating pads will need to be properly insulated electrically in order to prevent any current flowing to the wearer.

Preferably, the thermal garment includes at least one battery pack, one of which is connected to the resistive heating means.

A preferred type of battery pack is a rechargeable pack of nickel/cadmium batteries giving a rated voltage of 6 volts. It will thus be possible to provide a garment which will operate for about 8 to 10 hours before the battery pack is discharged.

Advantageously, the battery pack includes a positive coefficient thermal cut out (polyswitch) and a fuse arranged to ensure that any battery malfunction does not have any adverse effects.

Advantageously, the garment is provided with a number of rechargeable battery packs. For example it may be preferable to provide two battery packs with each garment so that the garment can be kept in constant use without needing to await a recharge of the battery pack. However, only one battery pack is required.

Preferably, the garment is also supplied with a battery charger which can recharge the battery in a period of approximately 10 hours, especially when using nickel/cadmium batteries, which should be charged at a low rate.

Battery chargers suitable for use with the garment of the present invention have been designed and can be made. The design has been devised such as to enable them to be used in conjunction with a battery pack especially made for use in the present invention.

Preferably, the means for connecting the battery pack to the heating pads, control unit or battery charger are designed so as to ensure correct connection is always achieved, thereby preventing the battery from being connected with the wrong polarity. Advantageously, the connectors are also designed so as to ensure that there can be no inadvertent disconnection of the circuitry.

Desirably, all the electrical or electronic components of the garment are encapsulated: so that the garment is entirely safe and the garment is at least water resistant.

The advantage of the present garment is that it does not require any further components. When a battery pack is inserted in the reinforced pocket, and connected to the circuitry, a current of no more than 1.5 amperes will be set up in the circuit. This will provide sufficient heat by resistive heating to keep an individual warm, even in the most severe of weather. Moreover, the garment can be worn as a normal article of clothing and will therefore not hinder normal movement. The maximum voltage applied by the battery is preferably 7 volts, most preferably 6 volts, which is not at a level to cause any danger to the wearer.

It can thus be seen that the present invention provides a thermal garment which can be used safely, conveniently and continuously to prevent the onset of hypothermia in a wearer.

Some specific embodiments of the invention are now described by way of example only with reference to the accompanying drawings in which:

Figures 1 to 3 show three forms of the thermal garment;

Figure 4 shows the main wiring circuit for the thermal garment as illustrated in Figure 1;

Figure 5 shows a diagrammatic representation of a typical heating pad that provides the heating means for the garment;

Figure 6 shows a diagrammatic representation of the control unit for the garment;

Figure 7 shows the circuit diagram for the control unit illustrated in Figure 6; and

Figure 8 shows diagrammatically the battery pack used with the garment.

Referring to the drawing, a thermal garment according to the present invention, as shown in Figures 1 to 3, essentially comprises a two layered garment 4. In Figures 1 to 3 only the outer layer 5 is shown. The inner layer (not shown) is of the same shape as the outer layer 5 and may be removably attached thereto, for instance by means of zip fasteners or Velcro®. The thermal garment also comprises: a control unit 30; a battery pack 7 and a plurality of resistive heating pads 10.

Both the control unit 30 and the battery pack 7 are attachable to the outer layer of the thermal garment, by means of reinforced pockets 9. The pads 10 are removably located in pockets in the outer layer 5 of the thermal garment. The pockets are sealable by suitable means, such as Velcro®. Thus, by simply removing the battery pack 7, control unit 30 and the heating pads 10 the garment can be washed without damaging the circuitry.

When the garment is in use the heating pads 10 are connected in series with each other and are also connected to the battery pack 7 and the control unit 30, for instance as shown in Figure 4.

A typical heating pad is shown in Figure 5. Each heating pad 10 comprises two parallel conducting strips 14 and 15 that are electrically connected to each other by a number of resistors 18. The number and ohmage of resistors 18 utilised is designed so as to achieve a desired level of heat output over the area of the pad 10. The resistors 18 and the conducting strips 14 and 15 are encapsulated in the form of a flexible plastic card.

The heating pads 10 are electrically joined to the circuitry, as shown in Figures 1 to 4, by means of electrical terminals 22 which are set in the card and which are electrically connected to the conducting strips 14 and 15.

The battery pack 7, as shown in Figure 8, comprises five nickel/cadium rechargeable batteries connected in series. Five "D" cells will give a rated output of 6V and 5.4AR. Five "F" cells will give a rated output of 6V and 7.0 AR. The pack 7 also includes a polyswitch 8, which is designed to cut out if a battery pack failure should lead to excessive heating in the battery pack, and a fuse. The battery pack 7 includes a connector 11 for connection to connector 48 (see below) of the control unit 30. The whole battery pack 7 is encapsulated so it is completely waterproof.

The control unit 30, as shown in Figure 6, comprises: a simple on/off switch 32; a screw-driver operated variable resistor 34 by which the wearer can adjust the temperature level of the thermal garment; a green light 36 to indicate that the unit is in use; a yellow light 40 to indicate that the heating pads 10 are in the process of heating the garment up to the required temperature level; a red light 38 and an audible alarm 42 to indicate when the battery power is low; a temperature probe 44 to measure the temperature of the garment when in use; and means 46 and 48 for connecting the control unit 30 to the heating pads 10 and battery pack 7 respectively.

The circuit diagram of the control unit 30 is shown in Figure 7. Its operation will be readily apparent to those skilled in the art, and thus no detailed description is given here.

The outer layer 5 of the garment is provided with elasticated sides and a zip fastener at its front. The garment also includes a waist belt (not shown). It can thus be ensured that the garment has a relatively tight, but comfortable, fit on the wearer. The garment also includes areas of reinforcement (not shown) extending from the shoulder areas down to the pockets for the battery pack and the control unit.

The design of the garment, and the placing of the heating pads ensures that the wearer is efficiently heated. For instance, the arrangement shown in Figure 1 will heat both the front and back of the whole chest area. Such an arrangement will be of use in extreme outdoor conditions. The arrangement shown in Figure 2 is for use in less arduous outdoor conditions or for arduous indoor conditions. The arrangement shown in Figure 3 is for use indoors, and is likely to be of most use for house-bound elderly people.

The garment is supplied with a battery recharger (not shown) having a connector for connecting it to the battery pack connector 11. All the connectors are designed so that inadvertent incorrect fitting of the connectors is impossible such that damage to the control unit or the battery pack can be avoided. The connectors are also designed such that they cannot inadvertently become disconnected during use.

It will be appreciated that the present invention has been described above by way of example only and that modifications and variations can be made by the skilled person without departing from the scope of the invention.

Claims

1. A close fitting thermal garment provided with: a plurality of resistive heating pads; a reinforced pocket for receiving a rechargeable battery pack; and means for connecting the battery pack in series with the resistive heating pads, wherein the total resistance of the resistive heating pads is between 4 and 8 ohms and the circuit is adapted to operate at a voltage of from 4 to 10 volts.

2. A garment as claimed in claim 1, wherein each resistive heating pad comprises a pair of parallel conducting strips which are electrically interconnected by a number of resistors arranged electrically in parallel and having terminals electrically connected to the respective ends of the conducting strips.

3. A garment as claimed in claim 2, wherein all the electrical components of each pad are encapsulated and are provided in the form of a flexible plastic card.

4. A garment as claimed in any one of claims 1 to 3, which includes a control unit detachably connected between the battery pack and the heating pads.

5. A garment as claimed in claim 4, wherein the control unit includes any of the following items: an on/off switch; means for adjusting the desired temperature level; means for indicating that the circuitry is switched on; means for indicating that power is being supplied to the heating pads; means for indicating that the output from the battery pack is below an acceptable level caused by operation of the circuitry.

6. A garment as claimed in claim 5, wherein the low output indicating means includes both an audible and a visible indicating means.

7. A garment as claimed in claim 5 or claim 6, wherein the temperature level adjusting means is arranged so that a maximum temperature of about 32°C is obtainable by the garment.

8. A garment as claimed in any one of claims 4 to 7, wherein the heating pads and control unit are removably located in or on the thermal garment so that they may be readily removed to allow the garment to be washed.

9. A garment as claimed in any one of claims 1 to 8, wherein the sides of the garment at least are elasticated to ensure that the resistive heating pads are brought into contact with the wearer.

10. A garment as claimed in any one of claims 1 to 9, wherein the garment is made of a material that is highly insulating.

11. A garment as claimed in any one of claims 1 to 10, which comprises two layers, the outer layer having on its internal face a number of sealable pockets for removably receiving the heating pads.

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12. A garment as claimed in any one of claims 1 to 11 which includes at least one battery pack, one of which is connected to the resistive heating means.

13. A garment as claimed in any one of claims 1 to 12, wherein the battery pack includes a positive coefficient thermal cut out (polyswitch) and a fuse.

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14. A garment as claimed in any one of claims 1 to 13, which is also supplied with a battery charger.

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15. A garment as claimed in any one of claims 1 to 14, wherein the means for connecting the battery pack to the heating pads, control unit or battery charger are designed so as to ensure correct connection is always achieved.

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16. A garment substantially described herein with reference to Figures 1 to 8 of the accompanying drawing.

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Fig.1.

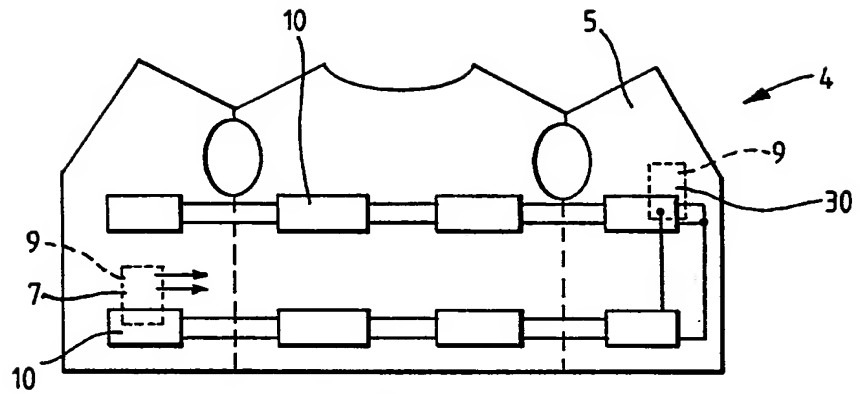


Fig.2.

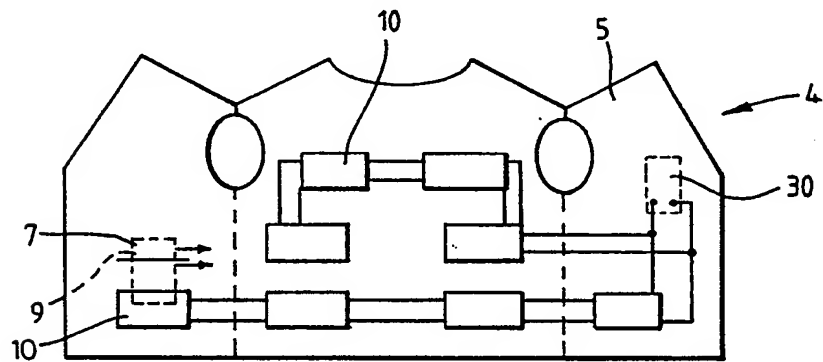
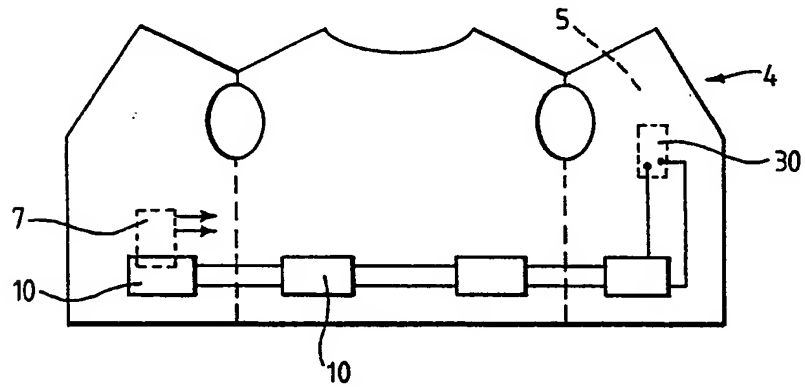


Fig.3.



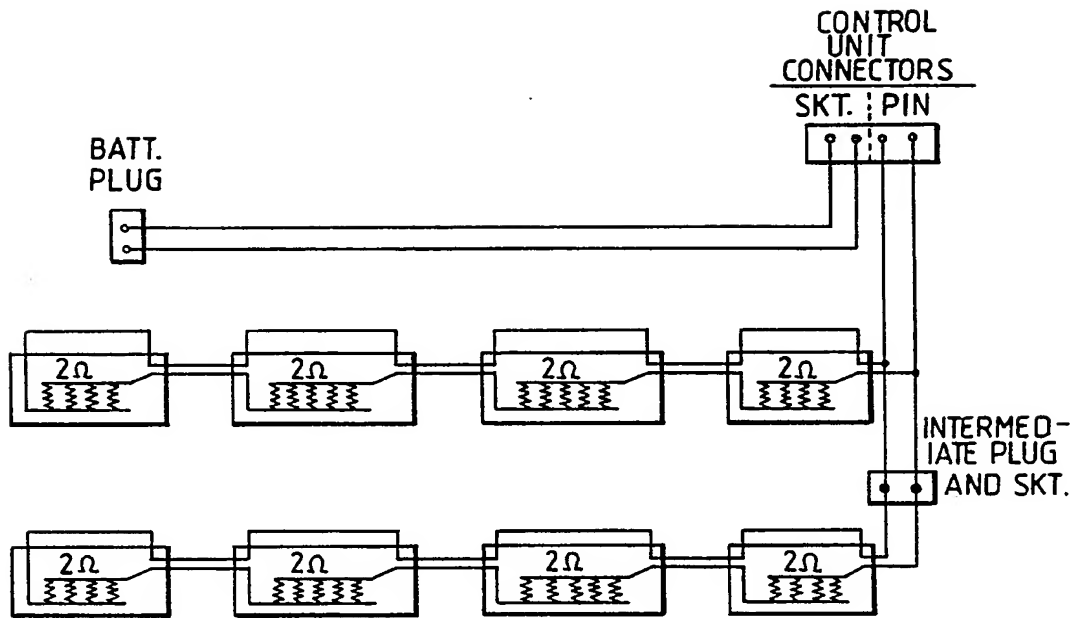


Fig. 4.

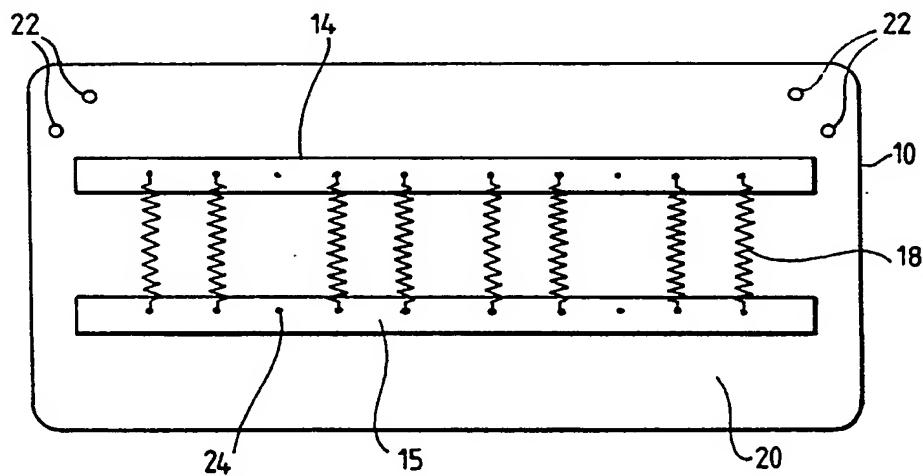


Fig. 5

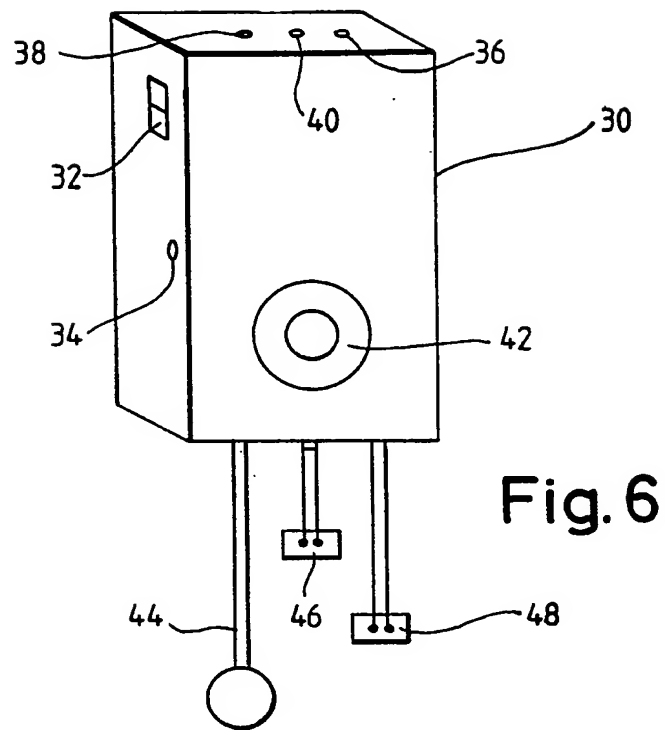


Fig. 6

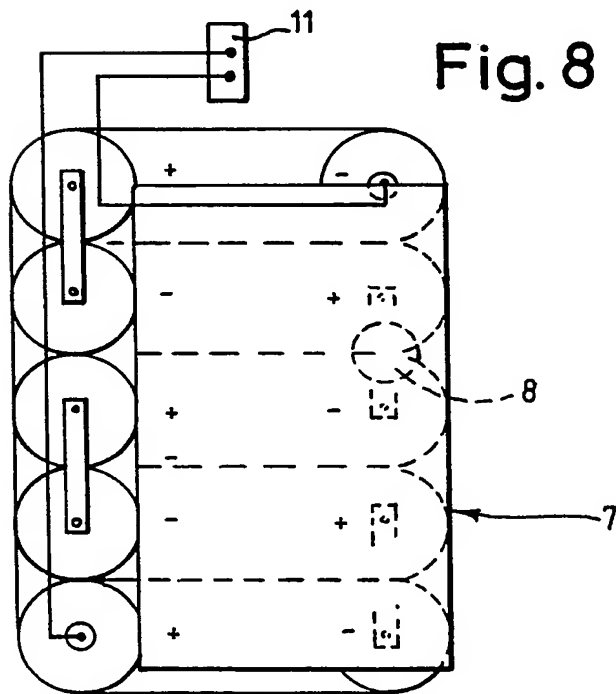
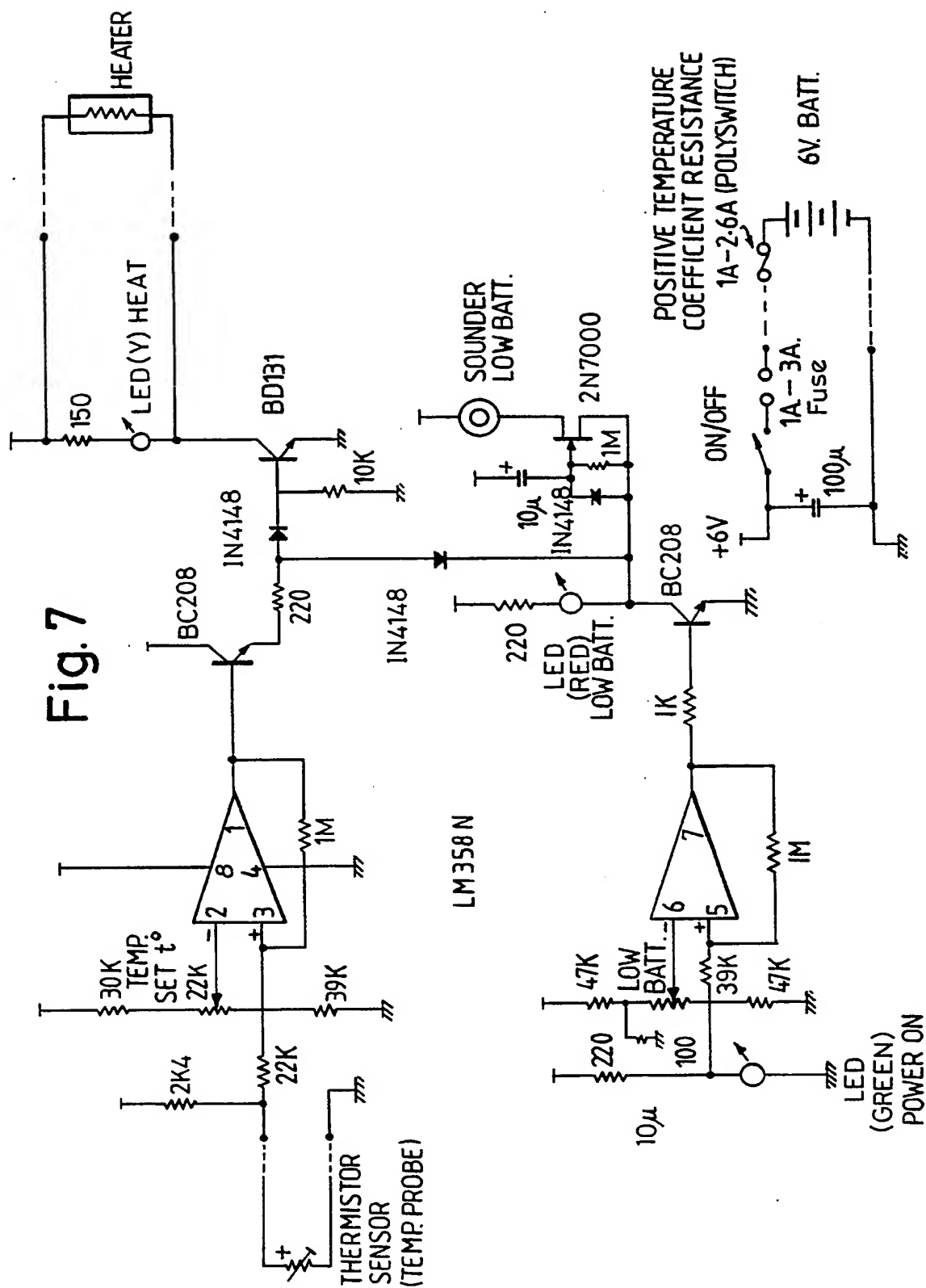


Fig. 8

Fig. 7





European Patent
Office

EUROPEAN SEARCH REPORT

Application Number

EP 88 30 3183

DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int. Cl. 4)
A	FR-A-1 430 669 (PECHIN) * Whole document *	1-3,5,8 ,12,16	A 41 D 13/00 H 05 B 3/34
A	US-A-2 277 772 (MARICK) * Page 1, column 2, lines 36-48; page 2, column 1, lines 27-75; page 2, column 2, lines 1-36; page 3, column 1, lines 36-65; page 3, column 2, lines 2-36; page 3, column 2, lines 58-75; page 4, column 1, lines 1-9; figures 1-10 *	1-3,8,9 ,11,16	
A	FR-A-2 577 390 (GROSSE) * Page 2, lines 1-26; claims; figure 1 *	1,4,10, 14,16	
A	FR-A-2 041 047 (RENFREW ELECTRONICS LTD) * Page 3, lines 14-33; page 4, lines 13-38; figures 6,7 *	1-3,9, 10	
A	US-A-3 644 705 (JOHNSON) * Column 2, lines 68-75; column 3 - column 4, line 44; figures 1-3 *	1,3,9, 12	TECHNICAL FIELDS SEARCHED (Int. Cl. 4) A 41 D H 05 B
A	FR-A-2 369 805 (LANGEVIN) * Page 1, lines 7-22; claims 1-5 *	1,13	
The present search report has been drawn up for all claims			
Place of search THE HAGUE		Date of completion of the search 21-07-1988	Examiner GARNIER F.M.A.C.
CATEGORY OF CITED DOCUMENTS			
X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document		T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons & : member of the same patent family, corresponding document	